

from the original.
F.H. 12 Oct 1864

THE MOON CONTROVERSY. (11)

NOBODY disputes the fact, which no one has satisfactorily explained, that the Moon always presents the same hemisphere to the Earth: so that one-half the Moon is never visible from the Earth; and the Earth is never seen from that half of the Moon, though always in view from the other half. Since the time of Galileo, most mathematicians have *assumed* that the Moon revolves round the Earth, and rotates on its own axis, in the same period and in the same direction. This *assumption*, known as the Dogma of the Moon's Rotation, is based on a sophism of Galileo, who *assumed* that a planetary body moving in a great circle would, of itself without any other movement, maintain its parallelism in space. This leads to another *assumption*, that if a body turns round to all points of the compass it rotates; and that it does not rotate unless it turns round to all points of the compass—which *assumes* that rotation is an effect, as well as the cause of that effect; or the result of turning round, instead of the particular mode of doing so. Were these *assumptions* undeniable, or undenied even, the Moon's Rotation would be a plausible hypothesis; but they have been not only denied, but often disproved. Consequently astronomers are continually

called upon to renounce the Dogma, and substitute some other theory that will account for her Librations, and that will satisfactorily explain why we always see the same face of the Moon.

Hence arises the Moon controversy. But the question has much more important bearings: inasmuch as other, fundamental, tenets of the present System of Astronomy are dependent on the same fallacies.

The terms Revolution and Rotation are not objected to. It is not a question of words, but of facts and principles. The upholders of the Dogma *assume* that the Moon, in travelling round the Earth (one movement), has (in addition) a second movement about her own axis. We deny the double motion, whatever it may be called. She may have either, but not both movements: if she travel round the Earth, she has no axial movement; if she have an axial movement, she does not travel round the Earth. It has been suggested, however, that these *Assumptionists* do not really mean literally what they say, but merely adopt a conventional fiction. If so, it is incumbent on them to amend their phraseology, and reform their doctrines accordingly. Facts cannot be altered to suit theories, so theories must be made conformable to facts.

H. PERIGAL, Jun.

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THE wheel of a carriage rotates on its axis while rolling along the road, turning all parts of its tire or periphery to the center of the Earth at each rotation: just as the Earth is said to rotate on its axis while revolving round the Sun. The wheel thus partakes of two movements, one of which is stopped while the drag is applied in going down hill, when the rotation ceases, and the lowest portion of the wheel slides along the ground; thereby keeping the same segment of its periphery towards the center of the Earth: just as the Moon keeps one and the same portion of her surface towards the Earth while revolving round us.

Why the Moon should thus travel with the drag always on is not so easily explained!—but it must be the case if she be the Satellite of the Earth. Now I cannot conjecture why the Moon should be the only Planet that does not rotate; nor how she can move through space without rotating. I am therefore inclined to doubt the fact of her being our Satellite—and to consider whether it be not more probable that if either be the Satellite of the other, the Earth is the Satellite of the Moon—in which case she would rotate once every time we revolve round her—the two movements being in

the same time and in the same direction. Perhaps, however, neither revolves round the other ; but each has an orbit of its own, round different centers.

I am not certain what the actual motion of the Moon really is ; but I am quite sure that it has not the double motion in question. If it revolves around the Earth, it certainly does *not* rotate on its axis. That Fact has been repeatedly demonstrated, both logically and mathematically, and *proved* experimentally by myself and others : while Airy, Whewell, and Lardner, &c. have vainly attempted to prove their Dogma. Now if the Moon had the two movements they say it has, of course it could be proved that such two movements would have the effect they anticipate : and if provable, such men could easily prove it, so as to obviate all doubt or cavil. Therefore the failure or absence of such proof is very very *strong presumptive evidence that the Dogma is untenable* : and this consideration has brought more converts to our opinion than all our own arguments and experiments. After the discussions of 1856, it was a common remark that ‘Jelinger Symons must be right, or Airy would have proved him wrong,’ when directly appealed to as Astronomer Royal !

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1748.

“His (Ferguson’s) Attack is directed against the *Criterion* of his Opponents, which is, that
‘A progressive Body, which keeps constantly
‘all its Diameters and Parts in the same Position with regard to the Line of its Progress,
‘does not turn on an Axis within itself, and
‘thereby in a circular Progress keeps always
‘the same Side to the Centre of its Orbit.
‘And, *vice versa*, if a Body in its Progress
‘continues varying the Position of its Diameters and Parts to its progressive Line,
‘it does turn on an Axis within itself.’
Whoever gave the Author this Criterion, gave it him not, I dare say, as a self-evident Axiom, but shewed also with it a Scheme of Proof to establish it. If he thought that Proof fallacious, yet the Criterion specious enough to be worth his bestowing some Thoughts upon it, surely it would have been much the shortest Way to have produced the Scheme, to have examined its Parts, and to have shewn where the Fault in his Reasoning lay; which would have put an End to the Dispute at once. But This he has not done.”

“If any theoretick Inventions or mechanical Contrivances can shew the Criterion to be falla-

cious, then most certainly some Part or other of the Argument brought to establish it is wrong, is either false in Position, or sophistical in Deduction. Here the Reprover ought to exercise his Sagacity; for whilst the Argument for Demonstration remains intire and unshaken, a thousand Experiments seemingly to the contrary must either be Deceits at the Bottom, or leave the Reprover under the grave Contemplation of an admirable Case where both Ends of a Contradiction are true, for ought that he can see to the contrary."—*Answer to FERGUSON'S Essay. 1748.*

If a body turns round its axis, while carried along a straight line, its component particles cross the line of march as often as the body rotates, the natural consequence of its axial movement. This must likewise be the case if the straight line be bent into the arc of a circle or into any other curve. In this manner the spokes of a wheel each in succession twice cross the line described by the center of the axle round which they turn in travelling along a level road or up and down hill, each and all pointing to the center of the Earth as well as to the heavens at every turn. It is obvious therefore that the *Criterion* of a century and a quarter ago, is still the *Criterion* of 1864, and will be for all time.

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434. "The lunar summer and winter arise, in fact, from the rotation of the Moon on its own axis, the period of which rotation is *exactly* equal to its sidereal revolution about the Earth.... The remarkable coincidence of the two rotations, that about the axis and that about the Earth, which at first sight would seem perfectly distinct,.... is the cause why we always see the same face of the Moon, and have no knowledge of the other side." (435.) "The Moon's rotation on her axis is uniform; but since her motion in her orbit.... is not so,.... the line joining the centers of the Earth and Moon fluctuates a little.... to the east or westward."

"Strange to say, there are persons who find it difficult to regard as a rotation on its own axis, that peculiarity of the Moon's motion which consists in its keeping the same face always towards the Earth. Should any of our readers be in this predicament, we recommend him to plant a staff upright in the ground, and, grasping it with both hands, walk round it, keeping as close to it as possible, with his face always turned towards it; when the unmistakeable sensation of giddiness will effectually satisfy him of the fact of his rotation on his own axis. Or he may walk round a tree, always facing it, and carrying a compass in his hand, and while watching the needle during a few circuits endeavour to persuade himself that he does *not* turn upon his own center."—*Outlines of Astronomy*, by Sir JOHN F. W. HERSCHEL, Bart., *fifth edition*, 1858.

Sir John would not have penned the above if he had investigated the matter. Had he tested it, he would have found that each particle of a person so moving would describe a circle round the staff or tree. All these circles would be concentric, and their centers would all concentrate in the axis of the staff or tree, but none of them in the axis or center of the experimenter. The movement, therefore, would *not* be rotation; neither would it be rotation and revolution, as he imagines; but revolution only: it is a single movement, not a double motion. He evidently adopts the usual mistake of confounding the terms 'rotation' and 'turning round'; using the word 'rotation' to express both the *effect* and the *mode* of turning round, instead of the particular way of turning (only): ignoring the fact that a body may turn round in two ways, separately or conjointly, either by an axial movement like the diurnal rotation of the Earth, or by an orbital movement like the Earth's annual revolution round the Sun: according to the Copernican doctrine, the rotation gives us $365\frac{1}{4}$ solar days and as many sidereal days, while the revolution gives us an additional sidereal day, because the two movements are in the same direction*.

If he had given an hour's consideration, and applied his analytical powers, to its investigation, he would have ascertained the true state of the case; and would have understood the necessity of rectifying the error—and its important bearing upon the science of Kinematics, especially in its principal branch, Astronomy.

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* See Willis's Principles of Mechanism, Art. 418.

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IF I place my thumb on the back of a chair, and attempt to turn myself round, I can scarcely complete a rotation without displacing my thumb. But if I walk round the chair, I can do so as often as I please with my thumb always in contact with it: showing that I do not rotate on my own axis, although turning successively to all points of the compass; and to the bystanders, who see all sides of me each time I complete the tour round the chair. If I attempt to keep my face towards one side of the room, I find it impossible while walking round the chair with my thumb on the back: showing that I must rotate as well as revolve to effect this parallel motion; which is not a single movement, but a double motion—compounded of two movements in opposite directions, which produce parallelism by mutually counteracting each other; “The one unturning while the other turns.”

I can move my hand in a circle, with the palm fronting one side of the room, by means of the two arcal movements of my arm. But if I try to do so when turning on my heel, I find it impossible for more than one turn.

If I place in the palm of my hand a mariner's compass, and holding it at arm's length turn round on my heel, “the magnetic force or directive power of the magnet keeps the compass-needle in the direction of North and South,” by causing it to turn on its pivot in the opposite direction with the same angular velocity; while the compass-box as well as my hand face successively all parts of the horizon. If I apply the stop, the

needle ceases to point N. and S., but points to all parts of the horizon, in common with my hand, as often as I turn myself round.

Suppose a lamp placed in the centre of a circular table; if standing near the table I turn myself round without leaving the spot, I face all the points of the compass, and see the lamp and all other objects around me. If I sidle round the table with my back always in contact with the edge, I again face all points of the compass; but I do not see the lamp or anything else on the table, though I see all other objects in the room as before. This is the distinctive difference between the two ways of turning round: the first was an axial movement only, the latter an orbital movement only; and in each case all my component particles moved in concentric circles. If the Moon be the satellite of the Earth, she must wheel round us in the same way that I sidled round the table, without any axial movement: and thereby turn herself to all objects outside her orbit, while keeping the same face to the Earth because it is within her orbit.

If I walk round the table, keeping my face always towards the North end of the room, I shall have all parts of my body, on a level with the table, successively in contact with it—and I shall see the lamp and other objects on the table, as well as all objects at the North end of the room—but I shall see nothing of my friends or other objects at the South end of the room: showing that this parallel motion is a double, and not a single, motion.

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